CURRICULUM GUIDE

INDUSTRIAL ARTS

POWER MECHANICS

10, 20, 30

DEPARTMENT OF EDUCATION
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A C K N O W L E D G E M E N T

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INDUSTRIAL ARTS

POWER MECHANICS

INTERIM

Introduction

Power Mechanics is the study of the sources and transmission of power. Through the reading and activities the student will engage in as he progresses through these units of study he will gain a concept of work, energy and power. It is not within the scope of this course to provide trades training but rather to introduce the students to the broad scope of energy sources, its transmission and application.

Testing and analysis makes up the core of the program. Facilities and equipment must be provided where such a program as outlined below can achieve the results expected.

The general approach in the course is that a student studies:

1. the total system e.g. 4 cycle engine
2. the units that comprise the system: carburetion, cooling, lubricating
3. the components that make up the unit, types of gears, bearings, jets, etc.

The study itself is to revolve around three basic topics:

(a) Principles of operation
(b) Control and analysis
(c) Application

When a, b, and c are applied to the study of 1, 2, and 3 above, an organized and systematic program can be presented.

Although four units comprise a year's work these may vary in length. In some areas such as turbines where equipment may not be available as much time will not be required. More time should then be spent on the other units.

This Power Mechanics course should focus on the application of scientific concepts in technology. Parallels of the utilization of scientific concepts should be drawn between their use in Power Mechancis and other technologies wherever possible. Terms and practices used should be explained scientifically and also as they apply to other technologies.

Specific Objectives

1. To help the student understand the many basic laws and principles of science at work in Power Mechanics and relate these laws and principles to the vast area of power technology.
2. To familiarize the student with the construction and requirements of machines which convert energy to useful work.
3. To develop problem-solving related to mac ines and their operations.
4. To help the student to understand the use, care and control of the power machine.

UNIT 1 -- Power Sources

The first unit of the grade ten Power Mechanics course requires a student to study two systems of power sources chosen from the following:

1. 4-stroke cycle gas
2. 2-stroke cycle gas
3. 4-stroke cycle Diesel
4. 2-stroke cycle Diesel
5. Wankel rotary engine

Course Content

What the student should:

DO	Know
A. Introduction	
1. Review definition of work, horsepower, torque, revolutions per minute, electrical power, mechanical power.	1. Concepts of Power Concepts of work, energy and power should be understood. Power (P) = Force (F) x Velocity (V) for linear power. P = FV
2. Introduction to measurement of: a. Rotational power	2. a. Power (P) = Force(F) x Lever arm(r) x Angular velocity(w) for rotational power. P = Frw b. Torque(t) = Force (F) x Lever arm(r) t = Fr Rotational Power = t x w

A. Introduction (cont'd.)

DO	KNOW
	c. Since $w = 2\pi N$ where N is the number of revolutions Then P is also equal to: from a. $Fr2\pi N$ from b. $t2\pi N$ Summary: (1). $P = F \times V$ for linear power Rotational Power (1) $P = Frw$ (2) $P = Fr2\pi N$ (3) $P = t2\pi N$
3. Use tools correctly. Identify fastening methods.	3. Proper use of tools and fasteners. Specific uses taught as needed.

B. Principles of Operation

DO	KNOW
1. Study cut-away model with aid of instruction sheet.	1. How this engine delivers torque. How mixture gets in and out of the combustion chamber; how it is ignited; where points of friction are.
2. Go to small shop engine of proper type and read operation instructions.	2. Preventive maintenance steps such as how to check oil, maximum revolutions per minute, starting and stopping procedure.
3. Start and stop the engine.	
4. Measure maximum torque curve on this engine at full throttle with varying loads.	4. Torque characteristics for this type of engine.
5. Compute power output from torque curve.	5. How revolutions per minute offset power output. Practical limitations of power increase with speed.
6. Study sub-systems of engine and identify the parts and their relationship. If necessary dismantle and re-assemble a shop engine of the type being studied.	

B. Principles of Operation (cont'd.)

DO	KNOW
7. Carburetion Study a fuel system to see: a. where fuel comes in and how mixture controlled b. where air comes in c. how mixture gets out of engine d. vary fuel ratios at carburetor or injector see effect on power output and/or fuel comsumption e. experiment with vacuum gauge to see effect of throttle on vacuum. f. test fuel pump	7. Principles involved - Bernoulli's Theorem - pressure differential - mixing air and fuel - evaporation by raising temperature - evaporation by reducing pressure - atomization by spraying - law of definite proportions - principles relevant to the system used - Pressure, vacuum, volume
8. Ignition	8. a. Principles of igniting fuel by: (1) battery system (2) magneto system (3) compression (Diesel)
a. Perform an experiment to find effect of spark timing or injection timing on power output on a test engine.	
b. Determine by experiment how crankshaft speed dictates when fuel injection or the spark should occur.	b. Principles of timing spark or injection.
9. Lubrication	9.
a. Perform experiments with friction to include sliding and rolling friction with wet and dry surfaces.	a. Principles of various types of bearings - plain - roller - ball - taper
b. Perform experiments with friction between various types of materials	b. Direction of pressure on various types of bearings.
c. Do dry and wet compression tests on engine with poor rings.	c. Sealing effect of oil.

B. Principles of Operation (cont'd.)

	DO	KNOW
d.	i. Mix mineral oil and water, also mix M.S. oil and water. Compare the results. ii. Mix oil with anti-freeze.	
e.	Study bearing materials.	e. Bearing materials - dissimilar metals: brass babbit - synthetics: nylon teflon
f.	Do experiments to show pour point and viscosity.	f. Qualities and ratings of oils. Selecting the right oil for the conditions. Oil additives.
g.	Trace oil path through the engine.	g. Methods of lubrication.
h.	Run a suitable engine to demonstrate crankcase dilution.	h. Crankcase dilution. Crankcase ventilation.
10.	Cooling Systems	10.
a.	Do an experiment to find the temperature drop of water flowing through a small automotive type heater core with air blowing through it.	a. Principles of heat transfer for air-cooled and liquid cooled systems.
b.	Pressure test on system.	b. Limitations for each system.
c.	Specific gravity and pour point of anti-freeze.	

C. Control and Analysis

DO	KNOW
1. Perform experiments to show that these three factors control power output.	1. Three factors of power output of internal combustion engine a. Brake Mean Effective Pressure B.M.E.P. b. Total displacement of cylinders c. Piston speed How these three factors can be controlled and altered to increase power and efficiency.
a. Compare power output at a constant speed for different air-fuel ratios.	a. The law of definite proportions.
b. Test volumetric efficiency versus speed for a given engine.	b. How and why volumetric efficiency varies with speed.
c. Displacement -its effect on power output.	
d. Effect of stroke on power and torque curves. Compare two similar-sized engines with different strokes.	
e. Use a small model engine with variable compression ratio to find effect of compression ratio on power output.	
f. Overall efficiency of an internal combustion engine.	f. Practical limitations of piston & crankshaft engines.

Other Practical Activities

1. Discover reasons for
   - Oil consumption
   - Overheating
   - Identify various engine noises

2. Adjust timing
   Carburetor adjustments
   Spark plug servicing
   High - speed tuning

1. Trouble shooting
   - Excessive oil consumption
   - Overheating
   - Engine noises

2. Tune up

D. Applications

The student must be able to relate his understandings to practical applications.

UNIT 2 -- Power Sources
(other than those listed under Unit 1)

This unit is to provide an overview of sources of power other than those that were studied in Unit 1.

Sources should include the following:

1. Electric motors, and three others from:

2. Turbines
3. Jets
4. Rockets
5. Nuclear
6. Steam

As some of these systems may not be available in the form of equipment, charts and other visual aids should be used.

Study each system in the same manner as outlined in Unit 1.
Consider:

A. Concept of power

B. Principles of Operation:
   1. Carburetion
   2. Ignition
   3. Lubrication
   4. Cooling

C. Control and Analysis

D. Applications

UNIT 3 -- Hydraulics and Pneumatics

Course Content

What the student should:

DO	KNOW
1. Inspect a closed hydraulic system -- hydraulic brakes, tractor hydraulic system, or lab simulating.	1. Basic principles a. Pascal's Law b. Problems in area c. Concept of pressure
	2. Safety precautions.
3. Set up experiments as outlined in manuals to varify concepts and principles listed in column headed "know". Select manual.	3. Principles of flow and properties of fluids.
	4. Symbols and glossary of terms.
	5. Hydraulic jacks and presses.
	6. The function and principles of operation of various hydraulic pumps -- plunger, centrifugal gear, rotor, vane.
	7. Basic hydraulic circuitry a. Single acting cylinder b. Double acting cylinder c. Use of valves
	8. Historical development of pneumatics.
9. Use slides and films.	9. Applications of pneumatics - industrial - marine - mobile - aerospace
10. Compare pneumatic with hydraulic circuits. List advantages and disadvantages of each.	10. Principles of pneumatic circuits.

UNIT 3 -- Hydraulics and Pneumatics (cont'd.)

DO	KNOW
11. Introduce fluidics. e.g. See film or read article on use of fluidics.	11. Basic principle of fluidics.

UNIT 4 -- Mechanical Transmission

The mechanical technology unit concerns itself with the transmission of power through a solid medium. A mechanical system is a fully integrated mechanism designed to perform a specific function. An analysis of any mechanical system reveals that there are a number of basic units made up of a variety of components. Not all units will be found in every system but all systems will have some.

The matrix below suggests an approach to analyzing any system.

Unit	Components
Input	Electric motor, internal combustion engine, turbine, solenoid, spring, etc.
Engagement	Friction clutch, pneumatic or hydraulic clutch, magnetic clutch, etc.
Coupling	Universal joints, shafts, levers, pins, gears, belts, etc.
Speed, Torque, Directional Change	Transmission, variable pulleys, planetary gear system, etc.
Power Division	Differentials, cam systems, etc.
Retarding	Brakes, etc.
Output	Cutting tools, wheels, plungers, presses, rams, etc.

Course Content

What the student should:

DO	KNOW
	1. Definition of "power" and related terms "work" and "energy".

Course Content (cont'd.)

DO	KNOW
2. a. Trace power flow through various mechanical devices i e lathe automobile b. Compare output with input of power transmission system	2. a. The need for power transmission. b. Mechanical advantage: the relationship between force and distance -- torque and speed. c. Directional changes in power transmission. d. Efficiency of power transmission minimizing frictional losses.
3 Experiment on linear measurement of power View film on measurements of draw-bar horsepower. Calculate horespower developed when climbing stairs.	3 Derivation of: a. Basic formulae used. b. Concept of "Effeciency". c. Linear measurement of power. d. Limitations of transfer of power from wheels to ground.
4 Measure power transmitted through 2 spur gears. Study automotive standard-gear-shift-type transmission Synchromesh. Calculate possible drawbar pull knowing torque at rear wheels.	4 Basic concept of torque and R.P.M. as the main components of power a. Calculation of torque and power that can be transmitted. b. Applications and limitations re gear changes etc.
	5. Concept of changes of R.P.M. and their relation to changes in torque.
6 Calculate power transmitted through belts and pulleys. View films on belt and chain drives.	6. Advantages and limitations of transmission of power by: a. belts b. chain drives.

Course Content (cont'd.)

DO	KNOW
7. Inspect and calculate ratios of various gear arrangements. Determine power transmitted through planetary gears.	7. a. Concepts of the components and operations of planetary gears. b. Calculation of gear ratios. c. Types of gears -- straight, spur, helical cut, bevel, spiral bevel, hypoid, worm, rack and pinion. d. Arrangement of gears in gear sets -- countershafts, idlers, planetary, differential, synchronized.
8. a. Determine the characteristics of a friction type clutch. b. Determine the characteristics of a fluid clutch.	8. a. The need for disconnecting power flow. b. Clutch systems -- dog, sliding gear, one way, centrifugal, cone, single, plate, multiple discs. c. Concept of the force normal to the surface of contact and of the co-efficient of friction. d. Torque limitations of the friction clutch. e. The principles of wet and dry clutch systems. f. Methods of engagement.
9. Examine and experiment with as many applications as possible.	9. The principles of mechanical power transmission through a. Shafts --- need for shaft supports, bearings, mounting blocks. --- need for flexibility in drive chain - universal joints, couplers, flexible shafts. b. Cables and ropes c. Cams d. Rods e. Air Screws f. Water Screws g. Axles h. Wedges and Impact Action

Reference List

1. Power Mechanics, George E. Stephenson, Delmar Publishing Inc.

2. Power Mechanics, (1961), Atteberry, General Publication.

3. Power -- Prime Mover at Technology, Duffy, General Publication.

4. Automotives Essentials, Ray F. Kuns, The Bruce Publishing Company.

5. Automotive Electrical Equipment, William H. Crouse, McGraw-Hill Book Co.

6. Motor Services Automotive Encyclopedia, Jud Purvis and William K. Toboldt, The Goodheart-Willcox Company, Inc.

7. Automotives Mechanics, William H. Crouse, McGraw-Hill Book Co., Inc.

8. Automobile Repair Manual, R.W. Bruce, Midland, Ontario.

9. Short Stories of Science and Invention ...
   General Motors Manuals
   General Motors Products of Canada
   Service Promotion Department
   Oshawa, Ontario.

10. National Fluid Power Association, P.O. Box 49, Thiensville, Wisconsin.

11. All About Small Gas Engines, (1960), Purvis, General Publication.

Engine Charts and Plans	Available from: General Motors Limited Ford Motor Company Chrysler Corporation Limited Caterpillar Tractor Company International Harvester Company Ltd.
Films	Shell Oil Company of Canada Ltd. General Motors Limited
Service Bulletins and Charts	Delco Remey Company Limited
Catalogs and Service Bulletins	Motor Car Supply Limited Snap-On Tools Limited
Service Bulletins and Manuals	General Motor Limited Ford Motor Company Chrysler Corporation Delco Remey Company Limited

Instructional Helps

Projects and Experiments

1. Making of cut-away models of internal combustion engine components (which will in turn provide development of hand skills in filing, fitting, drilling, grinding, sawing, and soldering.)

2. Experimenting with self-made models of venturi tubes.
Experiments with the prony-brake.
Experimentation with self-made combustion chambers and self-designed high voltage ignition systems.

Instruction Sheets

Distribution of weekly prepared information sheets designed as semi-finished notes. Such sheets to reveal the depth and scope of the course requirements.

2 Job sheets instructing students of methods and procedures for disassembly of components and stressing phases of major importance

3 Question sheets on jobs or projects completed.

4. Assignment sheets for major weekly assignment.

5 A minimum of ten information sheets on the major areas of the course stressing the principles and laws involved in the operation of the unit concerned.

In this course the information sheets should deal with:

1. Measurement of work, efficiency and power.
2 Operation of the internal combustion engine.
3 The principles of combustion.
4 Shop procedure.
5 Principles and properties of lubrication.
6. Cooling systems and their importance.
7. Carburetion.
8. Electrical induction.
9. The principles and laws of the internal combustion engine.
10. Auxiliary power units and the transfer of power.

Demonstration Materials

Demonstration materials from industry may be used to an advantage for the teaching of power mechanics concepts. However the following automotives components are easily obtained and may be used as a starting set of demonstration materials.

POWER MECHANICS 20

Introduction

This second course in power mechanics develops new and additional content to that studied in Power Mechanics 10.

Unit 1 -- Power Sources

Select two systems for study from the following list. Chooose systems that were not studied in Power Mechanics 10.

1. 4-stroke cycle gas
2. 2-stroke cycle gas
3. 4-stroke cycle Diesel
4. 2-stroke cycle Diesel
5. Wankel rotary engine

Study each system folkowing the outline given for Unit 1, Power Mechanics 10 under the heading below:

A. (Review) Concepts of Power
B. Principles of Operation.
   1. Carburetion
   2. Ignition
   3. Lubrication
   4. Cooling
C. Control and Analysis
D. Applications

Unit 2 -- Electric Power

The program of instruction, student experimentation and activities should be developed around the topics listed under course con tent. The purpose of examining the various types of power systems is to find out how they work, where they are used and how they are adapted to meet special demands required of them and their limitations. Overhaul and repair of the systems is secondary in importance to an understanding of their function, care and operation in an industrial setting.

Introduction - Electrical Power

How it is produced.

- Generators (Mechanical energy to Electric energy)
- Fuel Cells (Chemical energy to Electric energy)
- Primary and Secondary Cells (Chemical energy to Electrical energy)
- Thermocouples (Thermal energy to Electrical energy)
- Solar Cells (Light energy to Electrical energy)

Where it is used.

-Industrial plants (Motors, electric,furnaces, lights, communications.
-Space vehicles (Controls, communications, etc.)
-Medicine (Pacemakers, pumps, drills, etc.)
-Transportation (Diesel-electric trains, hoists ,cranes, etc.)
-Fabrication Industry (Welding, furnaces, electro-plating).

How it is transported and Controlled.

-Transmission lines, underground cable etc.)
-Transformers switches, rectifiers, fuses, etc.

Safety.

-Dangers related to the use of electricity.
-Necessary precautions in working around electrical equipment and circuits.

Course Content

What the student should:

	DO		KNOW
1.	Become familiar with all of the electrical power sources and systems that use electricity in the lab.	1.	That there are a variety of systems available for converting one form of energy into another (electrical).
2	Select a system at a time and become familiar with their operation , control , and adjustment.	2.	The student should know how to operate, control, and adjust as many systems as time will allow.
3	Do research to determine the answers to the following questions with respect to each system: What does it do? Where is it used? How does it work?	3.	The student should know what the system does; where it is used and how it works.
4	With the aid of models build an elementary generator and identify the major units and components.	4.	The units and components that make a generator. - Field - Armature - Frame - Tap (slip ring, brushes, etc.) - Load.

Course Content (cont'd.)

	DO		KNOW
5	Determine the function of each unit and component in the system.	5.	The function that each component plays in the system.
6.	Determine the principles of operation of generators.	6.	That a current is generated in a wire as it is passed through a magnetic field. That the strength of the EMF depends upon: - speed of the conductor through the field - strength of the magnetic field - number of turns of wire making up the conductor.
7.	Convert the AC model generator to a DC generator using a reversing switch or commutator.	7.	The difference between AC & DC generators and how to convert AC to DC.
8.	Improve the DC output by using a multi-coil armature provided in the model.	8.	How to improve DC output by increasing armature strength.
9.	Compare a lap wound and wave wound armature	9.	Know the value of different wound armatures.
10.	Build shunt series, and compound self-excited generator-field generators.	10.	The way to build shunt, series, and compound self-excited generators.
11.	Tests to compare the different types of generators.	11.	The different characteristics of different types of generators.
12.	Determine the sources of generator failure.	12.	The effect of: - open field circuits - reversed field connections - high shunt-field resistance - insufficient residual mag.
13	Do tests and determine the effect of load current on output voltage.	13.	The effect of load current on output voltage.
14.	Tests to determine generated EMF. Power output, power losses, efficiency, etc.	14.	How to determine power output, EMF, power losses, efficiency etc.

Course Content (cont'd.)

	DO		KNOW
15.	Investigate the use of fuel cells as a source of electrical powers.	15.	How a fuel cell operates. The use of formula will depend upon the student background.
16.	Determine the basic units and components that make up a fuel cell.	16.	Know the parts of a fuel cell.
17.	Investigate the use of various fuels used in fuel cells.	17.	Know the various fuels used and their relative merits.
18.	Determine the function of the various components of the fuel cell.	18.	Know the function of each component in the system.
19.	Tests to determine the output of a fuel cell.	19.	Be able to determine the output of a fuel cell.
20.	Compare the fuel cell with other sources with respect to output, efficiency and cost.	20.	Know the relative merits of the fuel cell with respect to other sources.
21.	Investigate the operation and construction of primary and secondary chemical cells.	21.	Know the operation and construction of primary and secondary chemical cells.
22.	Do tests to determine power output.	22.	Know the output of various cells.
23.	Do tests to determine the total power output and their ability to be recharged.	23.	Know the limitations of primary and secondary cells.
24.	Investigate the operation of thermocouples.	24.	Know how thermocouples operate.
25.	Investigate the principles of operation of solar cells.	25.	Know the principles of operation of solar cells.
26.	Compare their use of a power source with other power sources.	26.	Know the advantages, disadvantages, uses and limitations of solar cells.
27.	If equipment is available use these various power sources in a practical way to demonstrate their use.	27.	Know where and how to use these power sources and be able to demonstrate their practical application.
28.	Solve problems of a research nature as devised by the teached and determined by the ability and background of the student.	28.	The student should be able to solve simple problems of a research nature related to the area. The problem may have been previously solved by someone but yet it can be unique to a particular student.

Course Content (cont'd.)

	DO		KNOW
29	Investigate the operation of a simple DC motor.	29.	Know the operation of a DC motor.
30.	Determine the units and components that make up the system.	30.	Know the various parts of a DC motor.
31.	Determine the function of each unit and component.	31.	Know the function of each component.
32	Assemble a simple DC motor from a model kit.	32.	Know the proper relationship of parts and their organization into a system.
33	Reverse the direction of rotation of a simple DC motor.	33.	Know how to reverse the direction of rotation.
34	Perform tests to determine the relationship between torque and armature current drawn, field strength and speed of motor.	34.	Know what effect field strength and armature voltage has on speed of rotation.
35	Assemble a shunt DC motor.	35.	Know the operation of a shunt motor.
36.	Assemble a series DC motor.	36.	Know the operation of a series motor.
37.	Assemble a compound motor.	37.	Know the operation of a compound motor.
38.	Determine the function and use of starters.	38.	Know the function of starters.
39.	Do tests to determine the performance of various DC motors.	39.	Know the characteristics of various DC motors.
40.	Investigate the uses of DC motors in trains, hoists, cranes, etc.	40.	Know the effect of the demands of rapid acceleration, heavy loads, and light loads, and constant speed upon a motor. Know how to select the proper motor for the job.
41.	Investigate the operation of a simple AC motor.	41.	Know how an AC motor operates.
42	Determine the principles of operation in an AC motor.	42.	Know the principles of operation.

Course Content (cont'd.)

	DO		KNOW
43.	Assemble if possible, a synchronous motor, induction motor and shaded-pole motor	43.	Know the special characteristics of each kind of AC motor.
44.	Perform tests on the various motors such as stall. current and running tests.	44.	Be able to compare the relative merits of the various types of AC motors.
45.	Reverse the operation of these motors.	45.	Know how to reverse the rotation of various AC motors.
46.	Determine the relative merits of capacitor resistance and shaded-pole starters.	46.	Know the function of a starter on AC motors and the relative merits of each kind.
47	Calculate the R.P.M. for 2-pole and 4-pole.	47.	Know the effect of multiple poles on R.P.M.
48.	Compare the electric motor with the internal combustion engine as a source of power.	48.	Know the relative merits and demerits of various power systems.

Unit 3 -- Hydraulics and Pneumatics

1.	Experiments to verify and reinforce the concepts of hydraulic circuitry for the control and transmission of power.	1.	Bernoulli's theorem.
2	Compare the hardward used for hydraulics and pneumatics.	2.	Types of valves.
		3.	Sealing devices.
		4.	Accumulators.
		5.	Motors.
		6.	Pumps.

Course Content (cont'd.)

	DO		KNOW
		7.	Methods of flow control. (a) check valves (b) relief valves (c) pressure reducing valves (d) metering valves
8.	Experiments related to the gases: (a) Balloon inflation (b) Demonstrate water venturi (c) Heat fallon can, seal and cool (d) Problems related to theories.	8.	Laws of Gases (a) Pascal's Law (b) Charle's Law (c) Boyle's Law (d) Perfect Gas Law (e) Dolton's Law (f) Avogradro's Law (6.02×10^{23})

Unit 4 -- Electrical Transmission

	DO		KNOW
1.	Discuss and see film.	1.	Concepts of interrelationships between mechanical and electrical power.
2	Experiment with rectifiers (a) diodes (b) Tungar Tubes	2.	Interrelating units and formulae.
3	Circuit experiments.	3.	(a) The series circuit and problems in calculations of power (b) Symbols used.
		4.	Concepts re the characteristics of DC and AC.
5	(a) Determine ways of transmitting electric power (b) Determine power loss	5.	Reasons for power loss in transmission lines.
6.	Experiment with transformer action (a) Step up (b) Step down.	6.	Theory of transformer action - relation of voltage to amperage.

Course Content (cont'd.)

DO	KNOW
	7. Concepts of single phase and three phase AC.
8. Study changes in power and the interrelating formulae and units used. Experiment with overall efficiency.	8. Concepts of interrelationships of mechanical (levers, pulleys, etc.) and electrical.
9. See film of complex machine e.g. coal shovel.	
10. Experiment with overall efficiency of electric-mechanical-electric-heat conversions.	10. Concepts re the inter-relating units and formula between mechanical, electrical and thermal power.
11. Test a thermostat.	11. Principles of the operation of - thermostats - humidistats - barostats - hydrostats

POWER MECHANICS 30

Introduction

The Power Mechanics 30 course allows considerable freedom for the instructor to provide content suited to the individual class. In the previous two courses, most present-day sources of power were studied. The first two units of this course which deal with power sources allow the students to make a study in greater depth of not less than two of the systems that were introduced in previous courses.

Unit 1 -- Power Sources

Make a study in depth of a power source system of the student's choice.

Unit 2 -- Power Sources

Make a study in depth of a power source system of the student's choice not used in unit one above.

Unit 3 -- Power Transmission

Make a study in depth of one of the following:

1. Hydraulics
2. Pneumatics
3. Electrical Transmission
4. Mechanical.

Unit 4

Make a study in depth of one other transmission system listed in Unit 3 above.